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On the nematodes of amphibians of Poland, mainly from the environment of Łódź

Z badań nad nicieniami płazów Polski ze szczególnym uwzględnieniem okolic Łodzi

The first reports on the fauna of nematodes of *Amphibia* in Poland are given by Kowalewski (1895, 1907), who found the 3 most commonly occurring species of nematodes parasitizing in *Rana temporaria* (L.) and *R. esculenta* L. s. 1. To the widening of the informations so scanty as regards the nematodes of *Amphibia* in our country contributed works of Paul (1935) on the helminthofauna of *Amphibia* of Śląsk and of J. et E. Grabda (1953) on the parasites of *Salamandra salamandra* L. Sandner (1949) in his work on the parasites of *Amphibia* of the Warsaw environs records only generally the quantitative data concerning the occurrence of the nematodes in the separate species of *Amphibia*. During the last year there appeared reports on the studies of the parasites of *Amphibia* on the Lublin Palatinate, namely: *Rana terrestris* Andrz., (Kraczkowska, 1958), *Bufo viridis* Laur. (Kolendo, 1959) and *Trituris vulgaris* (L.) (Taranko-Tułecka, 1959).

The material elaborated in the present work was collected by the personnel of the Zoological Institute of the Polish Academy of Science, Division Łódź, since 1951 till 1955, generally from the beginning of April to the end of September, whereby the highest intensity of the collections occurred during the summer months: June, July and August. The prepondering number of *Amphibia* originated from 17 posts (579 individuals) situated in nearer of farther environs of Łódź. To compare the results also *Amphibia* from other regions of Poland were examined:

from Turew (Poznań Palatinate) — 98 individuals
from Górki Wschodnie (Gdańsk Palatinate) — 5 individuals
from Łeba Gdańsk Palatinate) — 6 individuals
from Święta Katarzyna and Święty Krzyż (Góry Świętokrzyskie) — 19 individuals.

The total number of 707 *Amphibia* belonging to the species listed in the table I was examined for the occurrence of the nematodes.

Table I
Invasion of examined amphibians by nematodes and other worms

Host	Examined	Invaded							
		Nematoda		*Trematoda*		*Acanthocephala*		*Cestoidea*	
		spec.	%	spec.	%	spec.	%	spec.	%
Rana esculenta L.s.l.	253	129	50.9	185	73.1	62	24.5	—	—
Rana temporaria L.	132	130	98.4	48	36.3	25	18.9	—	—
Rana terrestris Andrz.	193	187	96.8	39	20.2	55	28.5	1	0.5
Bufo bufo (L.)	27	26	96.3	4	14.8	—	—	—	—
Bufo viridis (Laur.)	27	25	95.0	3	11.0	—	—	—	—
Bombina bombina (L.)	39	35	90.0	15	38.5	24	62.0	—	—
Hyla arborea (L.)	4	3	—	1	—	—	—	—	—
Pelobates fuscus (Laur.)	10	1	10.0	—	—	—	—	—	—
Triturus vulgaris (L.)	14	12	85.0	—	—	—	—	—	—
Triturus alpestris (Laur.)	5	4	—	—	—	1	—	—	—
Triturus cristatus (Laur.)	3	1	—	—	—	—	—	—	—

Total parasitological dissections were performed but nematodes were found only in the intestine, abdominal cavity and lungs. Besides this in the urinary bladder were found larvae of some species of nematodes closer not diagnosed. The examined organs were rinsed under tap water. Ringer's solution was not used because it was observed that the parasites become detached from the tissues of the host easier in water.

In the examined *Amphibia* the following species of nematodes were found, whereby species hitherto not recorded in Poland are with asterisks: *Cosmocerca commutata* (Diesing, 1861), *Cosmocerca ornata* (Dujardin, 1845), *Oxysomatium acuminatum* (Schrank, 1788), *Oxysomatium brevicaudatum* (Zeder, 1800), *Oxysomatium brumpti* (Travassos, 1931)*, *Oxysomatium schneideri* (Travassos, 1931), *Oswaldocruzia bialata* (Molin, 1860)*, *Oswaldocruzia filiformis* (Goeze, 1782), *Oswaldocruzia molgeta* Lewis, 1928*, *Rhabdias bufonis* (Schrank, 1788), *Thominx costacruzi* (Travassos, 1932)* and *Thominx filiformis* (Linstow, 1885).

The Table I represents comparatively the state of the invasion of the examined *Amphibia* with nematodes and other parasitic helminths.

As shown in the table the degree of invasion of *Amphibia* with nematodes is higher than with trematodes, tapeworms or thorn-headed worms. Bychovskij (1932), Paul (1935) and Sandner (1949) suppose that the degree of the invasion of *Amphibia* with trematodes depends on the duration of time of the host's existence in water. The thesis of the cited authors seems to be corroborated by the comparison of the invasion of *Bufonidae* and *Ranidae* as shown in Table I. However, the relation between the invasion with nematodes and trematodes in *B. bombina* is nearer to the relation of the invasion in frogs which spend most of their life on the ground, although *B. bombina* is a typical aquatic form.

Tables II — X represent tabular arrangement and the intensity of the occurrence of the nematodes in the separate species of the examined *Amphibia*.

Systematic part

Cosmocercidae

Cosmocerca ornata (Dujardin, 1845)

This species occurred in the examined materials in the greatest number of hosts, because it was found in ± 50 % of the examined individuals. The intensity of invasion was from 1 to 32 nematodes per one host. In the individuals *C. ornata*, originating from various species of hosts, certain differences in the dimensions of their body

Table II

Invasion of *Rana esculenta* L.s.l. with nematode species

Locality	Examined	Invaded				
		C. ornata	*O. brevi-caudatum*	*O. schnei-deri*	*O. bialata*	*R. bufonis*
Łódź	227	47	3	4	42	2
Turew	17	6	—	—	3	—
Górki Wschodnie	4	2	—	—	—	—
Góry Świętokrzyskie	5	1	—	—	3	—
Total	253	56	3	4	48	2

Table III

Invasion of *Rana temporaria* L. with nematode species

Locality	Exa-mined	Invaded				
		C. ornata	*O. brevi-caudatum*	*O. schnei-deri*	*O. bialata*	*R. bufonis*
Łódź	120	82	46	6	89	93
Turew	5	3	—	—	3	—
Górki Wschodnie	1	—	—	—	1	—
Łeba	5	1	4	—	4	5
Góry Świętokrzyskie	1	—	—	—	1	—
Total	132	86	50	6	98	98

Table IV

Invasion of *Rana terrestris* Andrz. with nematode species

Locality	Examined	Invaded						
		O. fili-formis	*C. ornata*	*O. brevi-caudatum*	*O. schnei-deri*	*O. bialata*	*R. bufonis*	larva
Łódź	161	1	119	8	7	101	111	1
Turew	31	—	24	—	2	26	—	—
Łeba	1	—	1	1	—	1	1	—
Total	193	1	144	9	9	128	112	1

Table V

Invasion of *Bufo bufo* (L.) with nematode species

Locality	Examined	Invaded					
		C. ornata	*O. brevicaudatum*	*O. schneideri*	*O. filiformis*	*R. bufonis*	*T. costacruzi*
Łódź	13	9	1	—	11	11	1
Turew	11	10	—	2	10	7	—
Góry Świętokrzyskie	3	3	2	1	3	—	—
Total	27	24	3	3	24	18	1

Table VI

Invasion of *Bufo viridis* Laur. with nematode species

Locality	Examined	*C. ornata*	*C. commutata*	*O. brevicaudatum*	*O. brumpti*	*O. acuminatum*	*O. schneideri*	*O. filiformis*	*R. bufonis*
Łódź	4	1	—	—	—	3	—	3	1
Turew	20	4	11	—	3	1	1	14	13
Góry Świętokrzyskie	3	1	2	2	1	—	—	2	2
Total	27	6	13	2	4	4	1	19	16

Table VII

Invasion of *Bombina bombina* (L.) with nematode species

Locality	Examined	Invaded	
		C.ornata	*R. bufonis*
Łódź	34	31	12
Turew	5	3	—
Total	39	34	12

Table VIII

Invasion of *Pelobates fuscus* (Laur.) with nematode species

Locality	Examined	Invaded	
		O. filiformis	*R. bufonis*
Łódź	1	—	—
Turew	9	1	1
Total	10	1	1

Table IX

Invasion of *Hyla arborea* (L.) with nematode species

Locality	Examined	Invaded		
		C. ornata	*O. brevicaudatum*	*O. filiformis*
Łódź	4	1	1	1

Table X

Invasion of species of the genus *Triturus* with nematode species

Species	Examined	Invaded			
		O. brevicaudatum	*O. bialata*	*O. molgeta*	*T. filiformis*
Triturus vulgaris (L.)	14	—	12	12	—
Triturus alpestris (Laur.)	5	4	—	—	—
Triturus cristatus (Laur.)	3	—	1	—	1
Total	22	4	13	12	1

could be observed. Relatively the smallest were the nematodes collected from *Bombina bombina*. The difference between the mean length of *C. ornata* from *Bombina bombina* and that from *Rana terrestris* amounted to about 0.5 mm.

C. ornata was found in *R. esculenta, R. temporaria, R. terrestris, B. bufo, B. bombina, H. arborea* and occurred in the whole intestine, most numerously, however in the large intestine.

Cosmocerca commutata (Diesing, 1851)

C. commutata occurred rather rarely because barely in 1.8% of the dissected hosts and solely in *B. viridis*. The intensity of the invasion was from 1 to 31 specimens. *C. commutata* is a nematode of a wide geographical distribution. As reported by Paul (1935) it is on Śląsk the second as regards the frequency of the occurrence of nematodes in *Amphibia*, in Czechoslovakia Prokopič (1957) found it in *R. terrestris* and Sosnina (1952) notes it in *Amphibia* of Tadżikistan.

Oxysomatium brevicaudatum (Zeder, 1800)

O. brevicaudatum was found in the small and large intestine in 8.8% of examined *Amphibia*. Its hosts were: *Rana esculenta, R. temporaria, R. terrestris, Bufo bufo, B. viridis, Hyla arborea* and *Trituris alpestris*. Most commonly, because in 38% of the examined individuals it was found in *R. temporaria*. The intensity of the invasion was from 1 to 86 specimens.

Oxysomatium brumpti (Travassos, 1931)

The nematodes belonging to this species occurred barely in 0.6% of *Bufo viridis*, originating from Turew and Góry Świętokrzyskie. It constitutes a rare species, noted hitherto only on Corsica (Travassos, 1931).

The specimens described in the present work differed partially from those described by Travassos (1931). The length of the body of females was 3.86 — 4.59 mm, that of the males from 0.10 — 0.14 mm. The cuticula very minutely transversally striped. The excretory orifice 0.4 — 0.5 mm from the anterior end of the body. The oral cavity cone-like, about 0.01 mm in depth, with 3 lips.

The oesophagus about 0.5 mm in length, terminates with an oesophageal bulb of the size about 0.07 — 0.08 mm. In the anterior part of the oesophagus it is possible to notice the pharynx 0.03 — 0.04 mm in length.

The morphological structure of the female corresponds to the description given by Travassos (1931). The male is provided with a cone-like tail (Fig. 1), sharply pointed, 0.14 — 0.17 mm in

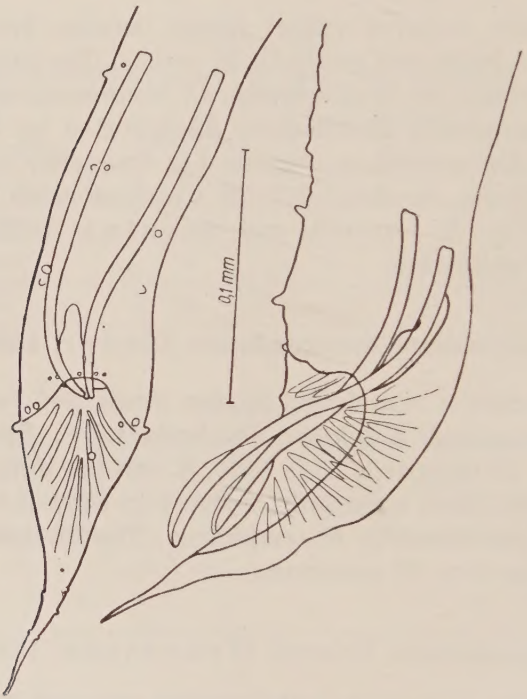

Fig. 1. *Oxysomatium brumpti* (Trav.). Tail of male

length, with sligthly visible papillae placed posteriorly to the anus and two rows of preanal and subventral papillae. The spiculae are almost of the same size, 0.18 — 0.20 mm in length, at the end provided with a membrane. The gubernaculum present. In all the three males found by me there could be observed in the tail part a notch in the form of a pseudo-sucker (Fig. 1).

Oxysomatium acuminatum (Schrank, 1877)

O. acuminatum occurred very seldom, because barely in 0.6%. It was found only in *Bufo viridis*. The intensity of the invasion was 1 — 3 individuals. Both Paul's (1935) and Mazurmovič's (1951) studies show that this parasite occurs in all *Anura*. Prokopič (1957) does not record at all this parasite.

Oxysomatium schneideri (Travassos, 1931)

The nematodes belonging to this species occurred in 3.1% of the examined material. Only males were found in *R. esculenta*, *R. temporaria*, *R. terrestris* and *B. bufo*. The intensity of the invasion was 1 — 4 individuals.

Interesting is the mode of the occurrence of *O. schneideri*. In spite of the fact that it parasitizes in several species of hosts, it was found barely in some localities. It is a rare species, hitherto found only in Germany, and in Poland (Kolendo, 1959).

Trichostrongylidae
Oswaldocruzia bialata (Molin, 1860)

Dubinina (1950) does not acknowledge the species separateness of *O. bialata* (Mol.) and of *O. filiformis* (Goeze) regarding that the basic characteristic which differentiates the two species — the occurrence or lack of lateral wings — is dependent on the freshness of the parasite at the moment of its fixation and on the fixative agent itself. She observed a gradual transition from forms provided with sufficiently wide wings to forms deprived of the wings. The results of the present work are not in agreement with the statement of Dubinina because I observed the lateral wings in *O. bialata* (Mol.) independently on the way the animal was preserved. Neither the existence of transitional forms of *O. bialata* (Mol.) and *O. filiformis* (Goeze) was confirmed therefore the two species are described separately.

O. bialata, a parasite of the small intestine occurred very frequently because in 47.4% of the examined *Rana esculenta*, *R. temporaria* and *R. terrestris*. This parasite was also frequently found in the intestine of *Triturus vulgaris* and *T. cristatus*. In the remaining species of *Amphibia*, *O. bialata* was not found. The intensity of the invasion was high and amounted from 1 — 30 individuals.

The data on the character of the occurrence of this species are not in agreement among the various authors. Paul (1935) does not record it at all. Mazurmovič (1951) describes it as one of the most rarely occurring in *Amphibia* and reports that they are invaded with it in 1%. The results of studies conducted by Prokopič (1957) corroborate fundamentally the data cited in the present paper, because in 139 *Amphibia* dissected by him there were 37 specimens invaded with this species.

Oswaldocruzia filiformis (Goeze, 1782)

Contrary to the previously mentioned species, this nematode occurred in frogs very seldom, because barely in 0.3% of the cases. It was found once in *Rana esculenta* and once in *R. terrestris*, the toads, however, were invaded by this nematode very strongly. Among the 54 examined *Bufo bufo* and *B. viridis* 43 were invaded with this parasite. Besides this, the nematode occurred also in *Hyla arborea* and *Pelobates fuscus*. The intensity of the invasion was from 1 to 30 individuals, similarly as in the case of *O. bialata*.

Prokopič (1957) found *O. filiformis* only in *R. terrestris*, Mazurmovič (1951) classifies this species to the most common parasites of *Amphibia* and missed to found it only in *R. terrestris*, *Hyla arborea* and *B. bombina*.

Oswaldocruzia molgeta Lewis, 1928

I found only one male of *O. molgeta* in the small intestine of *Triturus vulgaris* from the Łódź palatinate (Tomaszów Mazowiecki). In Central Europe and U.S.S.R. this species was hitherto not recorded.

Rhabdiasidae

Rhabdias bufonis (Schrank, 1788)

R. bufonis occurred very frequently because it was found in 36.6% of examined *Amphibia*. However, considerable differences could be oserved between the occurence of this parasite in aquatic and land frogs, because *R. esculenta* was invaded only in 0.8% of the cases, *R. terrestris* in 58% and *R. temporaria* in 74% of the cases. Similar extensity of invasion as in land frogs is observed in toads. This seems to be explainable taking into consideration the

Table XI

Species of nematodes found in examined species of amphibians

Parasite \ Host	*Rana esculenta* L. s. l.	*Rana temporaria* Laur.	*Rana terrestris* Andrz.	*Bufo bufo* (L.).	*Bufo viridis* Laur.	*Bombina bombina* (L.)	*Hyla arborea* (L.).	*Pelobates fuscus* (L.).	*Triturus vulgaris* Laur.	*Triturus cristatus* Laur.	*Triturus alpestris* Laur.	Number host species
Cosmocerca ornata (Duj.)	+	+	+	+	+	+	+					7
Cosmocerca commutata (Dies.)					+							1
Oxysomatium brevicaudatum (Zed.)	+	+	+	+	+		+				+	7
Oxysomatium acuminatum (Schrank)					+							1
Oxysomatium brumpti (Trav.)					+							1
Oxysomatium schneideri (Trav.)	+	+	+	+	+							5
Oswaldocruzia bialata (Mol.)	+	+	+						+	+		5
Oswaldocruzia filiformis (Goeze.)	+		+	+	+		+	+				6
Oswaldocruzia molgeta Lewis									+			1
Rhabdias bufonis (Schrank)	+	+	+	+	+	+		+				7
Thominx costacruzi (Trav.)				+								1
Thominx filiformis (Linst.)										+		1
Number of nematode species	6	5	6	6	8	2	3	2	2	2	1	

Table XII

Nematode species of amphibians, hitherto found in Poland

Nematode species \ Locality	Kozłowska (present paper)					Lublin Palatinate				
	Environment of Łódź	Turew	Góry Świętokrzyskie	Łeba	Górki Wschodnie	Kraczkowska (1958)	Kolendo (1959)	Taranko-Tułecka (1959)	Environm. of Bielsko E. Grabda, J. Grabda (1953)	Wrocław Palatinate Paul (1935)
Cosmocerca ornata (Duj.)	+	+	+	+	+	+	+	–	–	–
Cosmocerca commutata (Dies.)	–	+	+	–	–	–	–	–	–	+
Oxysomatium brevicaudatum (Zed.)	+	–	+	+	–	–	–	–	+	+
Oxysomatium acuminatum (Schrank)	+	+	–	–	–	–		–		+
Oxysomatium brumpti (Trav.)	+	–	+	–	–		–	–	–	–
Oxysomatium schneideri (Trav.)	+	+	+	–	–	–	–	–	–	–
Oswaldocruzia bialata (Mol.)	+	+	+	+	+	–	–	–	–	–
Oswaldocruzia goezei Skrjab. et Schulz	–	–	–	–	–	+	+	+	–	–
Oswaldocruzia filiformis (Goeze)	+	+	+	–	–	–	–	–	+	+
Oswaldocruzia molgeta Lewis	+	–	–	–	–	–	–	–	–	–
Rhabdias bufonis Schrank	+	+	+	+	–	+	+	–	–	+
Thominx costacruzi (Trav.)	+	–	–	–	–	–	–	–	–	–
Thominx filiformis (Linst.)	+	–	–	–	–	–	–	–	–	–

life cycle of *R. bufonis*, however *Bombina bombina* which lives in water shows also a high degree of invasion with this nematode. In newts the occurrence of this parasite was not observed. Neither is there in the literature any hint of the possibility of invasion of the European newts with species of the genus *Rhabdias*.

The intensity of invasion was high and amounted from 1 to 51 individuals. This nematode was found in the lungs, and sometimes in the course of a strong invasion also in the abdominal cavity.

It was noted that in accordance with Travassos' (1930) observations the dimensions of this nematode depend on the spiecies of the host. Individuals of *R. bufonis* from toads are larger than those from frogs.

Trichuridae

Thominx costacruzi (Travassos, 1932)

Only one male *Thomnix costacruzi* was found in the intestine of *B. bufo*. In Central Europe and U.S.S.R. this species was hitherto not recorded.

Thominx filiformis (Linstow, 1885)

Several individuals *Th. filiformis* were found in the intestine of *Triturus cristatus* collected from the Łódź palatinate (Tomaszów Mazowiecki). This nematode was hitherto not recorded in Central Europe and U.S.S.R.

Tabular arrangement of the results of studies

In Table XI is represented a tabular arrangement of the separate species of nematodes found in the examined species of *Amphibia*.

The species of nematodes parasitizing in *Amphibia*, found in separate localities by investigators interested hitherto in the helminths of *Amphibia* in Poland are represented in the Table XII. This table does not offer a basis for accurate orientation as regards the occurrence of those parasites on the terrain of Poland, because the studies were conducted only in few localities and in some of them not a sufficient number of *Amphibia* were examined. In spite of this it can be already observed that *Oxysomatium brevicaudatum*, *Oswaldocruzia filiformis* and *Rhabdias bufonis* are nematodes occurring in *Amphibia* in various localities in Poland. Three spe-

cies of the nematodes (*Oswaldocruzia molgeta*, *Thominx costacruzi* and *Th. filiformis*) were hitherto found exclusively in the environs of Łódź.

This work was completed in the Zoological Institute of the Polish Academy of Sciences, Division Łódź. I owe cordial thanks to Docent doctor H. Sandner for his kind offer of the theme of the present work, which is a continuation of his studies formerly initiated on the parasites of *Amphibia*, and to Docent doctor W. Romaniszyn for reviewing the manuscript.

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STRESZCZENIE

W latach 1951 — 1955 autorka zbadała helmintofaunę 707 płazów z okolic Łodzi, Turwi k. Poznania, Górek Wschodnich (woj. gdańskie), Łeby (woj. gdańskie) oraz Św. Katarzyny i Św. Krzyża (Góry Świętokrzyskie). W niniejszej pracy podano tylko wyniki badań, dotyczące nicieni.

Tabela I przedstawia stan zarażenia badanych płazów. W tabelach II — IX podano zestawienie oraz ekstensywność inwazji nicieni u poszczególnych gatunków badanych płazów, w tabeli X — zestawienie poszczególnych gatunków nicieni znalezionych w badanych gatunkach żywicielskich, a w tabeli XI — zestawienie nicieni płazów, znalezionych przez różnych polskich atuorów na terenie naszego kraju.

Autorka znalazła 12 gatunków nicieni, z których *Oxysomatium brumpti* (T r a v.), *Oswaldocruzia bialata* (M o l.), *O. molgeta* L e w i s, *Thominx costacruzi* (T r a v.) i *Th. filiformis* (L i n s t.) są nowe dla Polski.